Claims

I claim:

1. A method of embedding auxiliary information within original data, the original data being divided into a series of groups, each group in the series characterized by a numerical value, the method comprising:

   (a) investigating a first group to determine the presence of a local masking opportunity; and

   (b) if the first group indicated the presence of a local masking opportunity, embedding data by setting the value of one or more groups in the neighborhood of the first group, including the first group, in accordance with the value of a portion of the auxiliary data,

   whereby allowing data to be embedded efficiently.

2. The method of claim 1 in which

   (a) determining whether the first group represents a local masking opportunity includes examining the value of the first group and its relationship to a value of at least one other group near the first group; and

   (b) embedding data by setting the value of one of the nearby groups includes setting a value dependent upon the value of the first group and on the value of the portion of auxiliary data.

3. The method of claim 1 in which

   (a) determining whether a first group represents a local masking opportunity includes determining whether the first group

   (i) exceeds a predetermined threshold;

   (ii) is a peak; and

   (iii) the second group value differs from the first group value by a predetermined amount; and

(b) embedding data by setting the value of the second group such that the difference between the first and second group are set by the portion of auxiliary data.

5 4. The method of claim 1 in which

(a) determining whether a first group represents a local masking opportunity includes determining whether

(i) the first group exceeds a predetermined
10   threshold;

(ii) the previous group did not exceed the predetermined threshold;

(iii) the change in slope from the previous to the following group is less than another
15   predetermined value; and

(iv) the difference between the first and previous group is less than yet another user defined value; and

(b) embedding data by setting the value of the
20   second group such that the change in slope using the previous two group values is set by the portion of auxiliary data.

5. The method of claim 1 in which

(a) determining whether a first group represents a
25   local masking opportunity includes determining whether the first group exceeds a threshold; and

(b) embedding data by setting the value of the first group includes changing the value of one or more bits of the first group.

30 6. The method of claim 1 in which each group represents a value of the same quantity measured at a different frequency.

7. The method of claim 1 in which nearby groups includes groups within 50 groups sequentially of the
35   first group.

8. The method of claim 2 in which the original data represents the scaling factors or frequency coefficients of bit-rate reduced data, such as MPEG data.

5 9. The method of claim 2 in which each group represents a sample of audio data.

10. A method of retrieving auxiliary information within original data, the original data being divided into a series of groups, each group in the series

10 characterized by a numerical value, the method comprising:

(a) investigating a first group to determine the presence of a local masking opportunity; and

(b) if the first group indicated the presence of a

15 local masking opportunity, retrieving data by measuring the value one or more groups in the neighborhood of the first group, including the first group,

whereby allowing data to be retrieved efficiently.

20 11. The method of claim 10 in which

(a) determining whether the first group represents a local masking opportunity includes examining the value of the first group and its relationship to a value of at least one other group near the first

25 group; and

(b) retrieving data by setting the value of one of the nearby groups includes setting a value dependent upon the value of the first group and on the value of the portion of auxiliary data.

30 12. The method of claim 10 in which

(a) determining whether a first group represents a local masking opportunity includes determining whether the first group

(i) exceeds a predetermined threshold;

35 (ii) is a peak; and

(iii) the second group value differs from the
first group value by a predetermined amount;
and

(b) retrieving data by setting the value of the
second group such that the difference between the
first and second group are set by the portion of
auxiliary data.

13. The method of claim 10 in which

(a) determining whether a first group represents a
local masking opportunity includes determining
whether

(i) the first group exceeds a predetermined
threshold;

(ii) the previous group did not exceed the
predetermined threshold;

(iii) the change in slope from the previous to the
following group is less than another
predetermined value; and

(iv) the difference between the first and previous
group is less than yet another user defined
value; and

(b) retrieving data by setting the value of the
second group such that the change in slope using
the previous two group values is set by the
portion of auxiliary data.

14. The method of claim 10 in which

(a) determining whether a first group represents a
local masking opportunity includes determining
whether the first group exceeds a threshold; and

(b) retrieving data by setting the value of the
first group includes changing the value of one or
more bits of the first group.

15. The method of claim 10 in which each group
represents a value of the same quantity measured at
a different frequency.

16. The method of claim 10 in which nearby groups
    includes groups within 50 groups sequentially of the
    first group.

17. The method of claim 11 in which the original data
    represents the scaling factors or frequency
    coefficients of bit-rate reduced data, such as MPEG
    data.

18. The method of claim 11 in which each group
    represents a sample of audio.

19. An apparatus for performing the described data
    embedding or retrieving process comprising of
    (a) a logic processor; and
    (b) a storage unit,
    whereby the logical processor and storage unit can
    perform the described process.

20. The apparatus of claim 19 wherein the logic
    processor is digital processor and the storage unit
    is digital memory.

21. The apparatus of claim 19 wherein the logic
    processor and the storage unit consists of a
    combination of analog and digital circuitry.

22. The apparatus of claim 19 used to embed auxiliary
    information wherein the logic processor and storage
    unit include
    (a) a comparer device for comparing a group value in
        the series with a predetermined data and with at
        least one nearby group value to determine whether
        the group value represents a local masking
        opportunity;
    (b) data writer for storing the original data and
        embedded data onto a storage media, the data
        writer changing a group value of the original data
        in the vicinity of the local masking opportunity
        to embed auxiliary data in the original data to
        produce combined data, the local masking

opportunity reducing the likelihood of perception
of the changed value when the combined data is
presented to the user; and

(c) said comparer determining additional local
masking opportunities and the data writer changing
corresponding group values in the vicinity of the
additional local masking opportunities until all
the auxiliary data is embedded in the original
data or until no additional local masking
opportunities are located or required.

23. The apparatus of claim 19 used to retrieve
auxiliary information wherein the logic processor
and storage unit include

(a) a comparer device for comparing a group value in
the series with a predetermined data and with at
least one nearby group value to determine whether
the group value represents a local masking
opportunity;

(b) said comparer providing the auxiliary data from
the local masking opportunity; and

(c) said comparer determining additional local
masking opportunities and auxiliary information
data bits
whereby the apparatus is efficient.

24. A method of bypassing removal of embedded data
during digital bit-rate reduction (i.e. compression)
which includes using separate data embedding
techniques for non-compressed and compressed data.

25. The method of claim 24 in which the auxiliary
information is not lost during the compression
(a.k.a. encoding) by

(a) retrieving the auxiliary information from the
non-compressed data;

(b) compressing the combined data; and

(c) re-embedding the auxiliary information using an
appropriate technique in the compressed data,
whereby the compressed data still has the auxiliary
information embedded.

5   26. The method of claim 24 in which the auxiliary
information is not lost during the decompression
(a.k.a. decoding) by
(a) retrieving the auxiliary information from the
compressed data using an appropriate technique;
10   (b) decompressing the compressed information; and
(c) embedding the auxiliary information in the non-
compressed data,
whereby the non-compressed data still has the
auxiliary information embedded.

15   27. A method of preventing unauthorized copying of
audio data files, the audio data file being divided
into a series of samples, each sample in the series
characterized by a numerical value, the method
comprising:
20   (a) determining whether a first sample represents a
local masking opportunity by examining the value
of the first sample and values of at least one
other sample near the first sample;
(b) if the first sample represents a local masking
25   opportunity, embedding a portion of unauthorized
copy prevention data by setting the value of one
of the nearby groups in accordance with the value
of a portion of the copy prevention data, the
local masking opportunity allowing the portion of
30   the unauthorized copy prevention data to be
embedded with minimal perception by a user of the
audio file;
(c) locating additional local masking opportunities
to embed additional unauthorized copy prevention
35   data within the audio data file; and

(d) upon attempting to copy the audio data, verifying whether the combined data includes copy prevention information and, if so, preventing a copy from being produced.

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